ISSN (print) 0093-4666 © 2015. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/130.471

Volume 130, pp. 471–478 *April–June 2015*

Two new species and a new record of *Leptogium* from China

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Abstract — *Leptogium taibaiense* sp. nov. and *L. wangii* sp. nov. both have short hairs composed of cylindrical cells on their lower surfaces and are glabrous and smooth on their upper surfaces. *Leptogium burgessii* is a new record for China.

Key words —taxonomy, *Ascomycota, Peltigerales, Collemataceae*

Introduction

Thirty-nine species of the lichen genus *Leptogium* (Ach.) Gray have been reported in China, among which 18 hairy species were recorded in Mainland China (Wei 1991, Wang et al. 2010, Liu & Guan 2012, Liu et al. 2012, Cao et al. 2012, Xi & Liu 2014). A recent collection of a short-haired *Leptogium* from Beijing did not correspond with any named species and is described here as a new species, *L. wangii*. Other herbarium specimens of short-haired *Leptogium* species studied were found to represent a second new species, described here as *L. taibaiense*, and a new record for China, *L. burgessii*.

Materials & methods

A dissecting microscope (Motic SMZ-140) and light microscope (Motic B2) were used for the morphological and anatomical studies. Photographs were taken with BX51 fluorescence microscope. The type specimens of *Leptogium taibaiense* and *L. wangii* are deposited in Herbarium Mycologicum Academiae Sinicae–Lichenes, Beijing, China (HMAS-L). Other specimens are deposited in HMAS-L or Herbarium of Kunming Institute of Botany, Academia Sinica, Kunming, China (KUN).

Taxonomy

Leptogium taibaiense H.J. Liu & M.Q. Xi, **sp. nov.** PL. 1A–E

MYCOBANK MB 809221

Differs from *Leptogium puberulum* by its horizontal, entire, broader lobes and its corticolous habitat.

TYPE: China. Shaanxi Province, Mt. Taibai, Temple Ping'ansi, 34°01′N 107°48′E, elev. 2700 m, on bark, 8/VI/1963, Jiang-Chun Wei 2604-1 (**Holotype**, HMAS-L 045039).

ETYMOLOGY: The species is named after the type locality, Mt. Taibai, Shaanxi, China.

THALLUS foliose, 5–6 cm in diam.; UPPER SURFACE grey green in most parts when dry, especially near margin, other portions grey-blue to darker, glabrous, smooth, partially minutely striate, matt; LOBES orbicular, 5–10 mm wide, flat, horizontal, the margins entire, downturned; ISIDIA and LOBULES absent; LOWER SURFACE paler, densely hairy, velvety, insertion of apothecia making distinctive depressions; HAIRS 25–50 µm long, composed of a row of cylindrical cells. APOTHECIA common, ± dense, laminal to submarginal, sessile to subpedicellate, 0.2–0.5 mm in diam.; DISC plane to convex, dark red-brown; THALLINE EXCIPLE thin, glabrous, smooth, concolorous with the thallus or slightly paler.

THALLUS 100 µm thick; CORTEX on both sides consisting of a single layer of subglobose, isodiametrical cells, 4–5 µm in diam.; PHOTOBIONT *Nostoc* in chains, spherical, 4–6 µm in diam.; HYPHAE regularly interwoven. APOTHECIA 420–440 µm thick; THALLINE EXCIPLE c. 80 µm thick at margin, with a cortex of a single layer of subglobose cells 4–6 µm in diam., and an algal layer of loosely interwoven hyphae; PROPER EXCIPLE subparaplectenchymatous to somewhat euthyplectenchymatous at margin, 10–20 µm thick, but indistinct or sometimes euthyplectenchymatous in center; HYMENIUM 130–140 µm high; SUBHYMENIUM 30–40 µm high; SPORES 8 per ascus, submuriform, ellipsoid, 18–25 × 8–12 µm, 3-4-septate transversely, 1-septate longitudinally.

Corticolous.

REMARKS: *Leptogium taibaiense* is characterized by a combination of 1) the glabrous and smooth upper surface and 2) the velvety lower surface with short hairs composed of a row of cylindrical cells. Only three other species — *L. puberulum* Hue, *L. velutinum* P.M. Jørg., *L. wangii* (newly described, below) — have these characteristics. *Leptogium puberulum* differs from the new species by its ascending to erect, marginally sinuous, narrower (2–5 mm) lobes, its lack of proper exciple, its wider (14–16 um) spores, and its rock and soil substrate (Dodge 1973, Øvstedal & Smith 2001). *Leptogium velutinum* differs by its bluer upper surface, pedicellate apothecia, and larger spores (30–50 × 14–19 µm; Jørgensen 1997). *Leptogium wangii* (see below) differs by its pulvinate thallus, often concave and narrower (3–5 mm wide) lobes with sinuous and upturned margins, tomentose thalline exciple, euparaplectenchymatous proper exciple, and substrate of soil covered rocks.

Leptogium wangii H.J. Liu & J.S. Hu, sp. nov. Pl. 1f–j

MycoBank MB 809222

Differs from *Leptogium velutinum* by its narrower lobes, sessile apothecia, and smaller spores.

Type: China. Beijing City, Xiaolongmen National Forest Park, 39°57′N 115°26′E, elev. 1100 m, on soil covered rocks, VII/2013, Jian-Bin Chen & Xiao-Di Liu 2013-0714 (**Holotype**, HMAS-L 129380).

Etymology: This species is named in honor of Li-Song Wang M.Sc., a lichenologist who made numerous *Leptogium* collections from southwestern China.

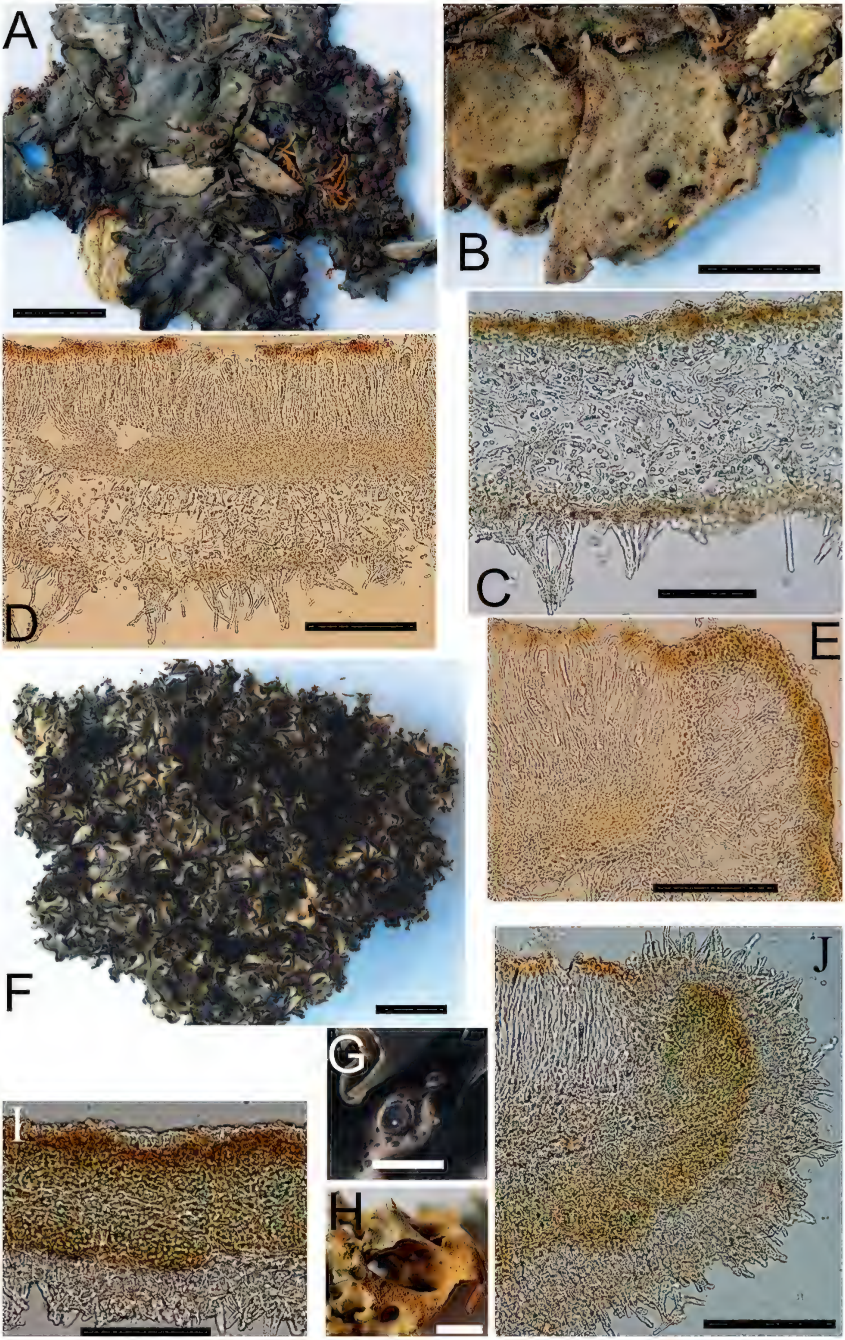
Thallus foliose, circular in outline, 5–6 cm in diam., pulvinate; upper surface grey-blue to brown when dry, glabrous, smooth to partially slightly striate, without wrinkles, dull; lobes 3–5 mm wide, often sub-erect, concave to sometimes flat, the margins sinuous, upturned; isidia and lobules absent; lower surface paler, velvety, densely hairy; hairs white, (25) 40–60 (70) µm long, composed of a row of cylindrical cells. Apothecia rare, laminal, 0.5 mm in diam., sessile; disc plane to concave, dark red-brown; thalline exciple smooth, white-tomentose, paler than the thallus.

Thallus 110–130 µm thick; cortex on upper side c. 10 µm thick, consisting of 1–2 layers of subglobose to ± elongated, isodiametrical cells, on lower side c. 20 µm thick, consisting of 2–3 layers of subglobose to ± elongated, isodiametrical cells; photobiont *Nostoc* in chains, spherical, 4–6 µm in diam.; hyphae closely regularly interwoven.

Apothecia 300–350 µm thick; thalline margin 50–60 µm thick, with a cortex of 3–5 layers of subglobose to ellipsoid cells; hymenium 130 µm high; subhymenium 20–30 µm high; proper exciple euparaplectenchymatous at margin, consisting of 3–5 layers of subglobose to ellipsoid cells, 40–60 µm thick, but often poorly developed and difficult to discern in center; lower cortex below the apothecium 70–80 µm thick, euparaplectenchymatous, consisting of 6–8 layers of subglobose to ellipsoid cells; asci clavate, 8-spored; spores submuriform, ellipsoid, 18–25 × 8–11 µm, 3 septate transversely, 1-septate longitudinally, obtuse to slightly acute at both ends.

On soil-covered calciferous rocks.

Remarks: *Leptogium wangii* is characterized by 1) a sub-erect, pulvinate thallus; 2) a smooth, glabrous, and often concave upper surface; 3) sinuous, ascending lobe margins; 4) short, cylindrical celled hairs on the lower surface; 5) a white tomentose apothecial margin; and 6) its habitat: soil- covered rocks. In habitus the new species closely resembles *L. puberulum*, which differs by its glabrous thalline exciples, broader spores (14–16 um wide), and absence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of proper exciple (Dodge 1973, Øvstedal & Smith 2001). It also resembles *L. velutinum*, which differs by its wider lobes (up to 20 mm), stalked apothecia, and larger spores (30–50 × 14–19 µm; Jørgensen 1997). For its differences from *L. taibaiense*, see remarks above.

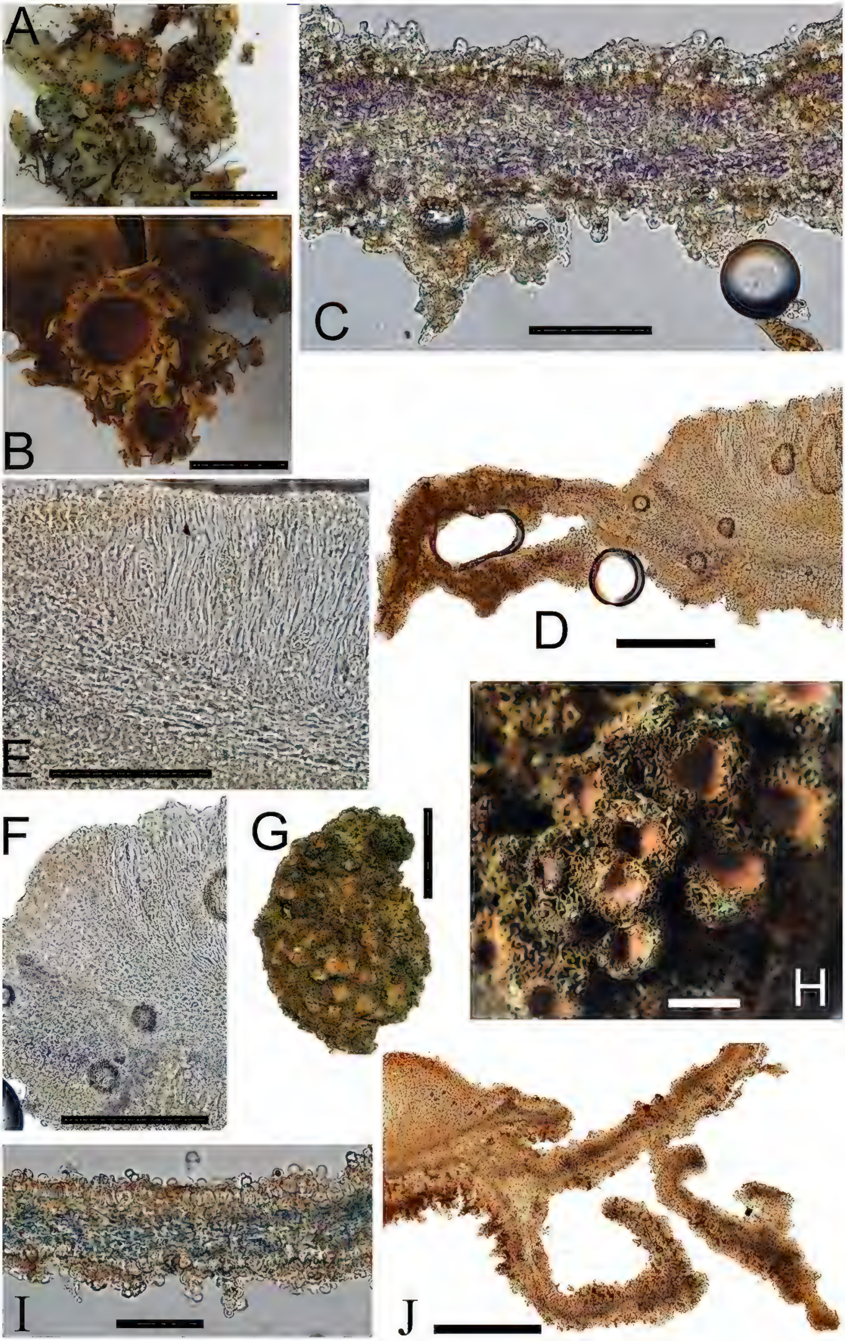
Leptogium burgessii (L.) Mont., Hist. Nat. Iles Canar. 3(2): 130 (1840). PL. 2

THALLUS foliose, 4–7 cm in diam., circular or irregular in outline; UPPER SURFACE grey-blue, dark grey-blue to brown when dry, glabrous, smooth, dull; LOBES horizontal, or often suberect, branched, 2–5 mm wide, rapidly narrowing towards margin, the margins sinuous, wavy, entire to microphylline; LOWER SURFACE paler, densely hairy; HAIRS white, 10–25 um long, composed of a chain of spherical cells. APOTHECIA few to abundant, laminal to submarginal, 0.5–5 mm in diam., sessile to subpedicellate; DISC plane to concave, red-brown or darker; THALLINE EXCIPLE concolorous with the thallus, microphylline; MICROPHYLLS free, abundant, occasionally fused at base in part and giving the thalline exciple a "collar" appearance (as in HMAS-L 032520; FIG. 2H), or only 1 or 2 whorls, not forming a "collar" (as in KUN 4846; FIG. 2B).

THALLUS 50–120 µm thick; UPPER CORTEX of a single layer of subglobose, isodiametrical cells, 5–10 µm in diam.; LOWER CORTEX similar to upper cortex, 8–12 µm thick; PHOTOBIONT *Nostoc* in chains, spherical, 3–7 µm in diam.; HYPHAE closely regularly interwoven. APOTHECIA 400–500 µm thick; THALLINE EXCIPLE euparaplectenchymatous, at the margin consisting of 2–5 layers of subglobose to ellipsoid cells, 50–60 µm thick, medullary tissues thin or absent, at the base with 6–12 layers of subglobose to ellipsoid, thin-walled cells, 110–150 µm thick; PROPER EXCIPLE euparaplectenchymatous and continuous with the thalline exciple laterally, consisting of 3–4 layers of subglobose to ellipsoid cells, 40 µm thick, soon becoming subparaplectenchymatous towards center and often indistinct basally; HYMENIUM 130–200 µm high; SUBHYMENIUM 30–40 µm high; ASCI clavate, 8-spored; spores submuriform, ellipsoid, 20–32 × 10–15 µm, 5–6 septate transversely, 1–2-septate longitudinally, obtuse at both ends.

Corticolous.

PLATE 1 (left). ***Leptogium taibaiense*** (HMAS-L 045039). A. Thallus with apothecia. B. Lower side of the thallus, showing depressions made by the insertion of apothecia, and short hairs. C. Thallus cross-section, showing single-layered cortex on both sides, and short hairs on lower side. D. Apothecium cross-section. E. Cross-section of apothecial margin, showing corticated thalline margin, marginally subparaplectenchymatous proper exciple, asci and spores. ***Leptogium wangii*** (HMAS-L 129380). F. Thallus, showing the suberect to erect lobes. G. An apothecium with tomentose apothecial margin. H. Lower side, showing the short hairs. I. Thallus cross-section, showing cortex, and short hairs on lower side. J. Apothecial cross-section, showing proper exciple and the corticated thalline exciple. Scale bars: A, F = 1 cm; B = 5 mm; C = 50 µm; D, E, I, J = 100 µm. G = 1 mm; H = 0.5 mm.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Specimens examined: **China. Yunnan Province**, Lijiang City, Yulong Snow Mountain, 27°05′N 100°10′E, on bark, elev. 2400 m, 24/XII/1964, J.C. Wei 2744 (HMAS-L 032520). **Sichuan Province**, Miyi County, Malong, Mt. Beipo, 26°58′N 101°50′E, on bark, elev. 3200 m, 7/VII/1983, L.S. Wang 83-846 (KUN 4846).

Remarks: *Leptogium burgessii* is a widespread species, known from South and North America, Europe, Macaronesia, Africa, New Zealand, and India (Sierk 1964, Awasthi & Akhtar 1977, Swinscow & Krog 1988, Galloway 1999, Jørgensen & Nash 2004, Aragón et al. 2005). It is new to China.

The species is characterized by smooth upper surface, short hairy lower surface, microphylline apothecial margins, and euparaplectenchymatous thalline exciples. *Leptogium mantiqueirense* Kitaura & Marcelli, *L. digitatum* (A. Massal.) Zahlbr., and *L. marginellum* (Sw.) Gray have microphylline appendages on the thalline margins, but can be easily separated from *L. burgessii* by their distinctly wrinkled upper surfaces. *Leptogium aucklandicum* Zahlbr. also has occasional microphylline outgrowths on the thalline exciples (Galloway 1999) but differs by its glabrous lower surface.

In the smooth upper surface, microphylline to entire lobe margins, and microphylline and euparaplectenchymatous thalline exciples, our specimens of *L. burgessii* are similar to those from most literatures, especially those from the Greater Sonoran Desert regions of the US (Jørgensen & Nash 2004). In the euparaplectenchymatous proper exciple they resemble the type of *L. inflexum* Nyl. (= *L. burgessii*; see Kitaura & Marcelli 2013). However, the Chinese materials have smaller spores than those from the Greater Sonoran Desert Region (25–50 × 14–22 μm; Jørgensen & Nash 2004), from India (25–45 × 12–16 μm; Awasthi & Akhtar 1977), and from Mexico (30–38 × 12–18 μm, type of *L. inflexum*; Kitaura & Marcelli 2013) and have larger spores than those from New Zealand (20–25 × 7.5–10 μm; Galloway 1999).

Acknowledgements

This study was supported by the National Natural Science Foundation of China (31093440, 31000239) and Natural Science Foundation of Hebei Province (C2014201032). The authors are indebted to Li-Song Wang M.Sc. (Kunming Institute

Plate 2 (left). ***Leptogium burgessii* (KUN 4846)**. A. Thallus with apothecia. B. Apothecia with microphylls. C. Thallus cross-section, showing corticated surfaces, and short hairs composed of globose cells on lower side. D. Vertical section of apothecium, showing microphylls on apothecial margin. E. Vertical section of the apothecium showing proper exciple euparaplectenchymatous at margin and subparaplectenchymatous towards center. F. Vertical section of thalline margin showing the connecting thalline and proper exciples. **(HMAS-L 032520)**. G. Thallus with apothecia. H. Apothecia with abundant microphylls on margin. I. Thallus cross-section, showing single-layered cortex on both sides, and short hairs composed of a row of globose cells on lower side. J. Vertical section of apothecium, showing microphylls on apothecial margin. Scale bars: A = 1 cm; B = 2 mm; C–F, I = 100 μm; G = 2 cm; H = 5 mm; J = 200 μm.

of Botany, CAS), Prof. Jiang-Chun Wei, and Ms. Hong Deng (Institute of Microbiology, CAS) for sending the specimens on loan. The authors are grateful to Dr. Udeni Jayalal (Department of Natural Resources, Sabaragamuwa University of Sri Lanka) and Dr. Ze-Feng Jia (College of Life Sciences, Liaocheng University) for reading and improving the manuscript, and for acting as presubmission reviewers.

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